

$\phi_u dx^\mu$, $\psi_u dx^\mu$, and $g_{\mu\nu} dx^\mu dx^\nu$ are all invariant to transformations of the four space-time coordinates.²

GEOLOGY.—*The Upper Cretaceous section in the Colob Plateau, southwest Utah.*¹ G. B. RICHARDSON, U. S. Geological Survey.

The Colob Plateau lies in southwest Utah, in eastern Iron and Washington counties and western Kane County, and extends from Cedar City and Kanarraville on the west to Orderville and Upper Kanab on the east. The name applies specifically to the bench underlain by the Cretaceous rocks, with the Eocene rocks of the Pink Cliffs rising above to the level of the High Plateaus—here known as the Markagunt and Paunsagunt—and with the bold escarpment of Jurassic and probably Jurassic rocks in the White Cliffs descending at the outer margin to the deeply eroded Triassic red beds.

The Cretaceous deposits of Colob Plateau are of interest to geologists in that they are on the western border of outcrops of the Cretaceous of the Interior Province and were very likely near the margin of the Upper Cretaceous sea in which the deposits were laid down. Some information on the Cretaceous rocks of the region has been included in several papers² though with but little detail as to fossils and sequence of strata. The data presented here were gathered a number of years ago and a first draft of the paper has lain unpublished for some time. No description of the Cretaceous strata of the Colob region has appeared in the meanwhile, however, and, so far as the

²With this form, the field equations (10), (11), and (13) show that $\bar{G}^{\mu\nu} - \frac{1}{2} \gamma^{\mu\nu} \bar{G}$ (for the six-space R_6) vanishes in all components in which space-time suffixes enter and the equations of motion (12) indicate that a charged particle follows a geodetic line in R_6 . It also appears that the resolution of charge into electric and magnetic (gravitational) components is physically indeterminate, which means that we may choose these two perpendicular directions x^5 and x^6 arbitrarily in their plane, thus altering the form but not the content of our description of nature. Certain other transformations such as $x = x'^5 + U(x^1, x^2, x^3, x^4)$ do not alter even the form of that description. Electricity and gravitation combined are thus viewed as manifestations of the geometry of a six-dimensional world of which space and time are a part. A relation of this proton to the hydrogen nucleus is suggested.

¹Published by permission of the Director, U. S. Geological Survey. Received Sept. 30, 1927.

²C. E. DUTTON, *Geology of the High Plateaus of Utah*. 1880; T. W. STANTON, *The Colorado formation and its invertebrate fauna*. U. S. Geol. Survey Bull. 106. 1893; W. T. LEE, *The Iron County coal field, Utah*. U. S. Geol. Survey Bull. 316. 1907; G. B. RICHARDSON, *The Harmony, Colob, and Kanab coal fields, southern Utah*. U. S. Geol. Survey Bull. 341. 1909.

writer knows, no more recent field studies have been made. It seems desirable, therefore, to make available the data in hand.

The Cretaceous strata of the Colob Plateau consist of 2500 to 3000 feet of buff to drab sandstones and shales, with subordinate lenses of gray limestone and, near the base, workable beds of coal. Approximately the lower three-fourths of these beds are of Colorado age and the uppermost part of Montana, probably late Montana, age. A generalized section follows:

GENERALIZED SECTION OF CRETACEOUS AND ASSOCIATED STRATA IN
COLOB PLATEAU, UTAH

Wasatch formation:

Varicolored beds of limestone, shale, and sandstone; conglomerate at base. Fresh water shells.....over 500 feet.

Unconformity.

Montana group (probably later part):

Buff sandstone and shale; conglomerate at base. Plants and fresh water shells.....about 500 feet.

Unconformity.

Colorado group:

Buff sandstone and drab shale in the east, as much as 1000 feet thick and of marine origin; hiatus in the west.

Drab marine shale in the east, as much as 1000 feet thick; changing to interbedded shale and sandstone in the west, with the shale of lesser importance.

Sandstone, shale, and coal; in the east 300 to 400 feet thick and non-marine; in the west, very much thicker and non-marine in lower part, marine in upper part. Conglomerate at base.

Total about 2500 feet.

Unconformity.

Morrison formation:

Varicolored shale and sandstone with lenses of limestone and gypsum about 400 feet.

Unconformity.

San Rafael group:

Massive gray limestone, subordinate lenses of gypsum. Marine shells about 400 feet.

The limestone of the San Rafael group yielded fossils identified by T. W. Stanton as *Trigonia* sp., *Plicatula* sp., *Cidaris?* sp., *Camptonectes* sp., and *Lima occidentalis* Meek and Hayden. These determine the age of the beds as Upper Jurassic. The overlying varicolored deposits have not yielded fossils but there is very little doubt that they belong to the Morrison formation. At present the Morrison formation is assigned by the U. S. Geological Survey with doubt to the Cretaceous though many geologists believe it better placed in the late Jurassic.

The Upper Cretaceous strata lie unconformably upon the Morrison formation with an undulating contact. The basal member consists of a variable bed of conglomerate from 15 to 30 feet thick, composed of rounded pebbles of quartzite and limestone up to six inches in diameter. Fossil plants have been found not far above this bed³ and marine shells of Colorado age occur still higher. Its exact age and relation to the similar units in other parts of Utah, often designated Dakota (?) sandstone, are not determinable. In this paper the conglomerate will be considered as basal Colorado.

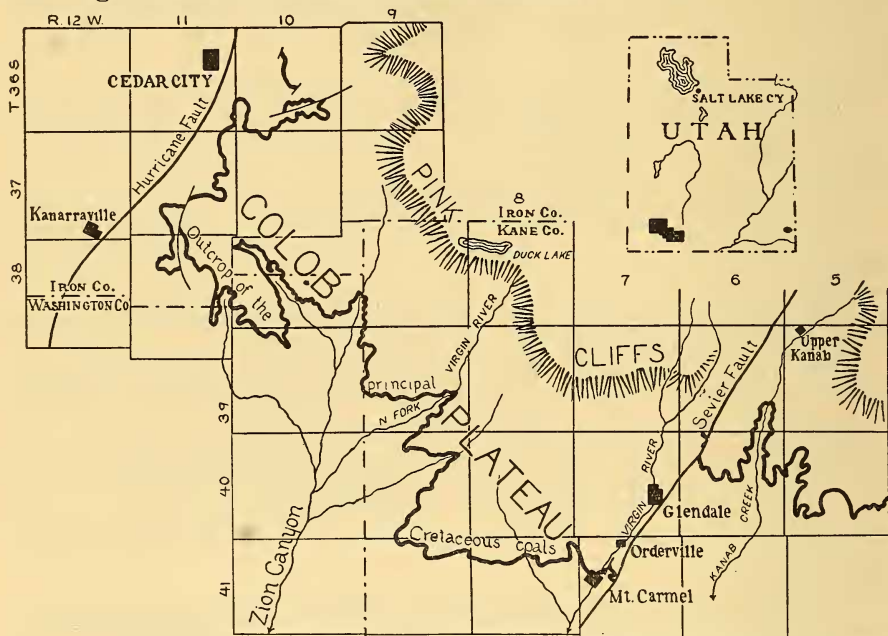


Figure 1.—Index map of Colob Plateau, southwest Utah

The rocks of Colorado age are about 2500 feet thick and above the basal conglomerate consist of buff, fine grained, quartz sandstones with much calcareous cement; buff, drab, and dark carbonaceous sandy and clayey shales; thin lenses of gray limestone; and one or more beds of coal within the lower 700 feet of the formation. The succession of strata is varied and even adjacent sections are unlike in detail. In general view, there is in the east a relatively thin coal-bearing basal sandstone unit, a middle thick shale unit, and an upper sandstone unit. Toward the west, the lower sandstone unit thickens at the expense of the shale unit and the shale unit itself

³ T. W. STANTON, oral communication.

acquires sandstones. The upper unit is apparently absent through removal by erosion before the deposition of the overlying Montana beds. These changes result in the absence of the important shale unit in the western section, though it is conspicuous in the eastern section, as, for example, in Long and Kanab Valleys.

Faunally the Colorado group in the Colob Plateau may be divided into four units, the lower two of which are really two facies—in a broad view contemporaneous but in individual sections coming in succession. The coal-bearing beds in the lower part of the group contain littoral and brackish-water species, of which the most common, according to T. W. Stanton, to whom I am indebted for examining all of the collections of shells, are *Ostrea soleniscus* Meek, *Cyrena* sp., *Corbula nematophora* Meek, *Glaucania coalvillensis* Meek, *Eulimella funicula* Meek, *Admetopsis rhomboides* Meek, *A. subfusiformis* Meek. These species are associated at Coalville, Utah, with the principal coal bed, and most of them have been found also in the Oyster Ridge sandstone member of the Frontier formation in southwest Wyoming.

The beds above the coal-bearing zone, the lower part of the shale unit in the east and the upper part of the lower sandstone unit in the west, contain a purely marine fauna which includes among many other species the following: *Gryphaea newberryi* Stanton, *Inoceramus labiatus* Schlotheim, *Liopistha (Psilomya) meeki* White, *Turritella whitei* Stanton, *Baculites gracilis* Shumard, *Helicoceras parianse* White, *Metoicoceras whitei* Hyatt. This fauna occurs widespread in the lower Benton and equivalents, such as the basal Mancos shale of eastern Utah, New Mexico, and Colorado, and the Mowry shale and Frontier sandstone of central Wyoming. In these areas there is no zone of brackish-water fossils comparable to that described in the previous paragraph, the marine fauna constituting the first in the section, and the whole sequence of deposits is thinner. It seems very likely therefore that the marine fauna in the region to the east is contemporaneous with both the brackish-water and marine faunas of Colob Plateau and that the differing thickness is due to relative distance from the source of the sediments.

Above the zone with *Metoicoceras* a zone of upper Benton age occurs, though it is not well represented in the collections. It is best distinguished by the presence of species of *Prionotropis*. This fauna is widespread also, occurring in the lower part of the Mancos shale, in the Carlile shale, and their equivalents. In the Colob Plateau this faunal unit is in the middle shale unit.

In the upper part of the Colorado group a fauna of brackish-water

and littoral species occurs, closely related to and in part identical with that of the basal Colorado. Most of the genera are repeated and some of the species. However, at Coalville, near Manti, and in the Kaiparowits Plateau, Utah, a similar zone contains, in addition to the less distinctive species, some that indicate a Niobrara age, and it seems reasonable to infer that the upper zone in the Colorado group of Colob Plateau is likewise of Niobrara age. This zone is apparently missing in the western Colob, for the overlying fresh-water beds of Montana age descend so low in the section that they rest upon beds that include the horizons of the *Prionotropis* fauna.

Above the Colorado group lie several hundred feet of buff sandstone and shale of Montana age. A conglomerate of rounded pebbles of limestone and quartzite forms the basal unit and rests on an uneven surface of older beds. This conglomerate is about 20 feet thick on the average. These Montana beds contain fresh-water shells, among them *Unio holmesianus* White, *Viviparus panguitchensis* White, and species of *Planorbis* and *Physa*—species known in late Cretaceous beds elsewhere. Fossil plants also occur. F. H. Knowlton examined the collections and made tentative determinations, some of them being listed on page 470, but the flora is chiefly undescribed and gives little help in correlation. A similar late Montana unit of fresh water origin is present at many places in central and eastern Utah.

The next younger unit in the sequence is an irregular succession of limestone, sandstone, and shale of various colors. The contact with the underlying rocks is marked by a surface of erosion and a basal conglomerate of rounded pebbles of limestone, quartzite, and the underlying sandstone. Fossils are rare in these rocks and only fragments of *Viviparus* and *Unio* were obtained, but the characteristic peculiarities of lithologic constitution and color leave room for little doubt that they belong to the Eocene Wasatch formation so well developed in other parts of the high plateaus of Utah.

It is of interest to compare the sections in several other areas in Utah that lie near the western border of the Cretaceous of the Interior Province with that in the Colob Plateau. The section near Salina and Manti⁴ shows almost exactly the same units as in the Colob. A thick lower unit, chiefly of sandstone, but containing also shale and conglomerate, has a lower Colorado marine fauna in the upper part.

⁴ E. M. SPIEKER and J. B. REESIDE, JR., *The Cretaceous shoreline in Utah*. Bull. Geol. Soc. Amer. 37: 429-438. 1926.

This is succeeded by shale with *Prionotropis*, and then a unit of sandstone and shale with a marine upper Colorado fauna. The Montana group is represented by a thick series of coarse-grained beds with a thin unit of coal-bearing strata near the top. The age of these Montana beds is not well established by fossils but it is believed that they are of late Montana age. At Coalville⁵ the succession of strata is more complicated but the sequence of faunal units, and, in a general way, of lithologic units, is parallel to that at Salina and Manti and in the Colob. A lower unit of sandstone, conglomerate, and shale contains a lower Colorado fauna; a second of shale with minor sandstone and conglomerate contains a middle Colorado fauna with *Prionotropis*; and a third unit of sandstone and shale contains a Niobrara fauna. Above the upper Colorado beds lies a unit of rather coarse beds with a fresh-water fauna and a flora of Montana, probably late Montana, age. The succeeding beds at Coalville and at Salina and Manti are unconformable Wasatch deposits.

The following sections show the composition and approximate thickness of Cretaceous strata in Colob Plateau and the horizons at which fossils were collected:

LOCAL SECTIONS

SECTION OF CRETACEOUS ROCKS ON MAPLE CREEK (T. 36 S., R. 10 W.), EAST OF CEDAR CITY, UTAH

Wasatch formation:

 Conglomerate, rounded pebbles of limestone and quartzite.

Unconformity.

Montana group:

	<i>Feet</i>
Concealed.....	110
Sandstone, massive buff.....	50
Concealed.....	90
Sandstone, massive buff, containing fragments of a dicotyledon, apparently <i>Platanus</i>	70
Concealed.....	45

Unconformity.

Colorado group:

Sandstone and shale.....	60
Shale, drab, with thin beds of sandstone.....	400
Sandstone, massive buff.....	150
Shale.....	70
Sandstone and shale, alternate thin beds.....	100
Sandstone and shale, containing many oysters.....	70
Sandstone, massive buff.....	45
Sandstone and shale, containing many oysters.....	60
Sandstone, massive buff.....	33
Sandstone, conglomeratic, containing scattered pebbles.....	12

⁵ C. H. WEGEMANN. *The Coalville coal field*. U. S. Geol. Survey Bull. 581. 1915.

Sandstone, massive buff (several layers full of oyster shells). About 500 feet above the base of the sandstone the following fossils were collected: <i>Gryphaea newberryi</i> Stanton, <i>Camptonec-</i> <i>tes platessa</i> White, <i>Liopistha (Psilomya) meeki</i> White, <i>Lunatia</i> <i>sp.</i> , <i>Turritella whitei</i> Stanton, <i>Baculites gracilis</i> Shumard?, <i>Heli-</i> <i>coceras pariense</i> White, <i>Metoicoceras whitei</i> Hyatt.....	1300
Sandstone, thin-bedded, fossiliferous.....	27
Sandstone, massive buff.....	38
Shale and marl containing the following fossils: <i>Cyrena</i> sp., <i>Corbula nematophora</i> Meek, <i>Glauconia coalwillensis</i> (Meek), <i>Eulimella funicula</i> Meek, <i>Admetopsis rhomboides</i> Meek, <i>Admetopsis subfusiformis</i> Meek.....	6
Coal and shale.....	2
Oyster bed.....	8
Sandstone, massive buff.....	45
Limestone, shaly, containing the following fossils: <i>Avicula gas-</i> <i>trodes</i> Meek, <i>Barbatia micronema</i> Meek, <i>Cyrena</i> (?) sp., <i>Corbula</i> <i>nematophora</i> Meek, <i>Glauconia coalwillensis</i> (Meek), <i>Eulimella</i> <i>funicula</i> Meek, <i>Admetopsis rhomboides</i> Meek, <i>Admetopsis</i> <i>subfusiformis</i> Meek.....	3
Coal and shale.....	6
Sandstone, massive buff.....	
Base concealed.	

Total measured 2800

SECTION OF CRETACEOUS ROCKS SOUTH OF BLACK MOUNTAIN (T. 37 S.,
R. 10 W.), EAST OF KANARRAVILLE, UTAH

Wasatch formation:	<i>Feet</i>
Conglomerate, rounded pebbles of limestone and quartzite, 1 to 6 inches in diameter.	
Unconformity.	
Montana group:	
Concealed.....	250
Sandstone, buff.....	21
Shale, light.....	17
Sandstone, buff, containing the following plants: <i>Dammarites</i> <i>caudatus?</i> Lesq., <i>Podozamites oblongus?</i> Lesq., <i>Podozamites</i> <i>angustifolius?</i> (Eichw.) Schimp., <i>Platanus newberryana?</i> Heer, <i>Platanus</i> sp., cf. <i>P. primaeva</i> Lesq., <i>Betula</i> cf. <i>B. beatriciana</i> Lesq., <i>Menispermities ovalis?</i> Lesq., <i>Cinnamomum</i> sp., <i>Vibur-</i> <i>num robustum</i> Lesq.....	11
Shale, light.....	15
Sandstone, buff.....	12
Shale, light.....	15
Unconformity.	
Colorado group:	
Sandstone, buff.....	11
Shale, drab.....	50
Sandstone, buff.....	3
Shale, drab.....	100
Sandstone, massive buff.....	15

Shale, drab, with thin beds of sandstone; contains the following fossils in the lower part: <i>Ostrea</i> sp., <i>Anomia</i> sp., <i>Modiola</i> sp., <i>Barbatia micronema</i> (Meek), <i>Cyrena</i> sp., <i>Corbula nematophora</i> Meek, <i>Eulimella funicula</i> Meek, <i>Chemitzia?</i> sp., <i>Admetopsis</i> sp.	700
Sandstone, massive buff, containing the following fossils in the upper part: <i>Ostrea</i> sp., <i>Cyrena</i> <i>Glaucônia</i> <i>coalvillensis</i> (Meek), <i>Admetopsis</i> sp.	600
Shale, carbonaceous.....	17
Sandstone, buff.....	12
Shale, drab.....	35
Sandstone, buff.....	20
Concealed.....	80
Shale, carbonaceous.....	22
Sandstone, buff.....	25
Coal and shale.....	4
Sandstone, buff.....	30
Concealed.....	35
Shale, carbonaceous.....	45
Coal.....	6
Shale, drab.....	6
Sandstone, buff.....	8
Shale, drab.....	21
Sandstone, buff.....	5
Shale, drab.....	17
Sandstone, buff.....	15
Shale, drab.....	70
Sandstone, buff.....	6
Shale, variegated.....	45
Shale, buff.....	100
Sandstone and shale.....	15
Shale, buff.....	20
Sandstone, buff.....	8
Shale, drab.....	25
Sandstone, buff.....	22
Shale, sandy, carbonaceous.....	10
Shale, buff.....	100
Limestone.....	2
Shale, drab.....	11
Sandstone, buff.....	10
Shale, light.....	5
Sandstone, buff.....	11
Conglomerate, pebbles of limestone and quartzite.....	30

Total 2713

Unconformity.
Morrison formation.

SECTION OF CRETACEOUS ROCKS FROM THE HEAD OF MUDDY CREEK SOUTH-
WEST TO NORTH FORK OF VIRGIN RIVER (T. 39 S., R. 8 W.), NORTH
OF ORDEerville, UTAH

Wasatch formation:

Conglomerate, pebbles of quartzite, chert, sandstone and por-
phyry (base of Wasatch?).

Feet

Unconformity.

Montana group:

Sandstone, buff.....	40
Concealed.....	75
Sandstone, buff.....	15
Shale, light.....	30
Sandstone, buff.....	11
Concealed.....	40
Shale, light.....	17
Sandstone, buff.....	26
Sandstone, with lenses of limestone, containing <i>Viviparus pan-</i> <i>guitchensis</i> White, <i>Viviparus</i> sp., <i>Physa</i> sp., <i>Planorbis</i> sp....	12
Concealed.....	150
Shale, light.....	15
Sandstone, buff.....	5
Shale, white.....	22
Sandstone, buff.....	11
Shale, light.....	18
Sandstone, buff.....	5
Shale, light.....	23
Sandstone, buff.....	16
Shale, purplish.....	5
Shale, light.....	17
Sandstone, buff.....	50
Shale, light.....	40
Sandstone, buff.....	41
Shale, light.....	11
Sandstone, buff.....	17
Concealed.....	15
Sandstone, buff.....	37
Sandstone, white.....	7
Sandstone, buff.....	15
Shale, light.....	20
Conglomerate, small rounded pebbles of limestone and quartzite	40

Unconformity.

Colorado group:

Sandstone, buff.....	22
Shale, light.....	40
Sandstone, buff.....	100
Shale, red.....	5
Sandstone, buff.....	100
Shale, light, streaked with red.....	20
Sandstone, buff.....	53
Concealed.....	50
Sandstone, buff.....	5
Concealed.....	25

Sandstone, buff.....	8
Concealed.....	20
Sandstone, massive buff.....	200
Shale, and thin-bedded sandstone.....	200
Sandstone, buff.....	40
Shale, drab.....	20
Sandstone, massive buff.....	110
Concealed, probably chiefly shale.....	100
Shale, drab.....	60
Concealed, probably chiefly shale.....	100
Shale, drab.....	70
Coal.....	2
Sandstone, white.....	50
Shale, drab.....	35
Concealed.....	125
Coal and shale.....	8
Shale.....	50
Sandstone, white.....	40
Shale, purplish.....	5
Sandstone, white.....	15
Conglomerate.....	15

Total 2539

Unconformity.

Morrison formation.

GENERALIZED SECTION OF CRETACEOUS ROCKS IN VALLEY OF VIRGIN RIVER NEAR MOUNT CARMEL, UTAH

Wasatch formation (?): Feet

Conglomerate.

Unconformity.

Montana group:

Sandstone and shale, zone of fresh water shells and leaves..... 700

Conglomerate, pebbles of quartz, $\frac{1}{4}$ to 1 inch in diameter..... 10

Unconformity.

Colorado group:

Sandstone and shale, alternating beds, containing in the lower part: *Ostrea soleniscus* Meek, *Anomia* sp., *Cyrena* sp., *Thracia* sp., *Corbula nematophora* Meek..... 1000

Shale (including a few thin beds of sandstone) containing near the top: *Prionotropis* sp., *Placenticerus* sp.; and the following forms near the base: *Pecten* sp., *Avicula* sp., *Inoceramus labiatus* Schlotheim?, *Liopistha* (*Psilomya*) *meeki* White, *Dentalium* sp., *Turritella whitei* Stanton, *Baculites gracilis* Shumard?, *Metoicoceras whitei* Hyatt..... 700

Sandstone and shale, coal-bearing..... 400

Conglomerate, pebbles of limestone and quartzite, 1 to 6 inches in diameter..... 15

Total 2825

Unconformity.

Morrison formation.

SECTION OF CRETACEOUS ROCKS IN SINK VALLEY, SOUTH OF UPPER
KANAB, UTAH

Wasatch formation:	<i>Feet</i>
Conglomerate, rounded pebbles of limestone and quartzite, 1 to 6 inches in diameter.	
Unconformity.	
Montana group:	
Sandstone, massive buff.....	55
Shale, drab.....	27
Sandstone, massive buff.....	30
Shale, light.....	6
Sandstone, massive, buff, containing the following fossils: <i>Unio</i> (casts of two or more species), <i>Physa</i> sp., <i>Planorbis kanabensis</i> White, <i>Campeloma</i> (?) sp., <i>Viviparus panguitchensis</i> White.....	60
Concealed (probably shale).....	27
Sandstone, massive buff.....	33
Conglomerate, rounded pebbles of limestone and quartzite, 1 to 2 inches in diameter.....	27
Unconformity.	
Colorado group:	
Sandstone, grayish-white.....	150
Shale, purplish-drab.....	20
Sandstone, massive buff.....	65
Concealed (probably shale).....	60
Sandstone, massive buff.....	16
Concealed (probably shale).....	50
Sandstone, massive buff, fine-grained.....	65
Sandstone, yellowish, coarse-grained.....	25
Sandstone, conglomeratic; pebbles small and scattered.....	5
Sandstone, massive, buff.....	50
Concealed (probably shale).....	10
Sandstone, massive buff.....	11
Shale, carbonaceous.....	7
Sandstone, buff.....	11
Shale, light.....	8
Sandstone, containing oysters.....	11
Sandstone, massive buff.....	100
Shale, drab, clayey and sandy, and local thin beds of sandstone, containing the following fossils in the lower part: <i>Inoceramus</i> sp., <i>Lucina</i> sp., <i>Liopistha</i> (<i>Psilomya</i>) <i>meeki</i> White, <i>Turritella whitei</i> Stanton, <i>Aporrhais prolabiata</i> (White), <i>Sigaretus textilis</i> Stanton (?), <i>Baculites gracilis</i> Shumard (?), <i>Helicoceras pariense</i> White, <i>Metoicoceras whitei</i> Hyatt.....	1200
Sandstone, massive buff.....	60
Shale, carbonaceous.....	25
Sandstone, buff.....	6
Shale, light.....	11
Shale, carbonaceous.....	20
Sandstone, massive, buff.....	25
Shale, drab.....	80
Coal and shale.....	8
Concealed (probably shale).....	40

Sandstone, gray.....	7
Conglomerate, rounded pebbles of limestone and quartzite.....	15
Total	2426

Unconformity.

Morrison formation.

SECTION OF CRETACEOUS ROCKS 5 MILES NORTHEAST OF
UPPER KANAB, UTAH

Montana group:	<i>Feet</i>
Sandstone, white, containing thin beds of shale.....	150
Sandstone, buff to white, containing: <i>Unio</i> sp., <i>Planorbis kana-</i> <i>bensis</i> White, <i>Viviparus panguitchensis</i> White, <i>Campeloma</i> <i>multilineata</i> M. & H.?, <i>Physa</i> sp.....	55
Shale, light.....	8
Sandstone, white.....	60
Sandstone, buff, containing the following leaves: <i>Cyperacites</i> sp., <i>Ficus</i> sp., <i>Laurus</i> sp.....	42
Sandstone, white.....	17
Conglomerate, pebbles of limestone and quartzite $\frac{1}{2}$ to 2 inches in diameter.....	33
Unconformity.	
Colorado group:	
Sandstone, white.....	145
Concealed (probably shale).....	20
Sandstone, buff.....	5
Concealed (probably chiefly shale).....	100
Sandstone, buff.....	5
Shale, drab.....	40
Sandstone, massive, buff.....	10
Shale, drab.....	18
Sandstone, massive, white.....	33
Concealed (probably shale).....	25
Sandstone, buff.....	20
Concealed (probably shale).....	15
Sandstone, massive buff.....	55
Shale, light.....	20
Sandstone, massive, buff.....	15
Concealed.....	40
Shale, drab.....	33
Sandstone, pinkish.....	55
Shale, light.....	5
Sandstone, buff, coarse-grained; locally conglomeratic.....	52
Sandstone, buff.....	43
Shale, drab.....	34
Sandstone, massive, buff.....	18
Sandstone, fossiliferous; containing: <i>Ostrea soleniscus</i> Meek, <i>Anomia</i> sp., <i>Barbatia micronema</i> (Meek), <i>Cyrena</i> sp., <i>Corbula</i> sp., <i>Admetopsis rhomboides</i> Meek, <i>Chemnitzia</i> (?) sp., <i>Priono-</i> <i>tropis</i> sp.....	22
Shale, light.....	5
Sandstone, massive buff.....	80
Shale, drab, clayey and sandy, with local thin beds of sandstone. (Same unit as 1200-foot shale in Sink Valley section, p. 473)	
Total measured	1278